

**Before the  
Federal Communications Commission  
Washington, D.C. 20554**

In the Matter of )  
 )  
Amendment of Part 90 of the ) WP Docket No. 07-100  
Commission's Rules )  
 )

**COMMENTS OF PCIA**

PCIA – The Wireless Infrastructure Association (PCIA), through counsel and pursuant to Section 1.415 of the Commission's Rules, 47 C.F.R. §1.415, hereby respectfully submits its Reply Comments in the above-captioned proceeding.<sup>1</sup>

**I. INTRODUCTION**

PCIA is a national trade association representing the interests of commercial and private mobile radio service communications industries. In addition, PCIA is the leading FCC-certified frequency advisory committee for the business and industrial radio services, certifying and sending thousands of applications per year to the Commission for commercial and private land mobile station authorizations in the 27-43 MHz, 150-174 MHz, 421-512 MHz, 800 MHz, 900 MHz and 929 MHz paging bands. PCIA is also the principal trade association representing the companies that make up the wireless telecommunications infrastructure industry. Its members include the carriers, infrastructure providers and professional services firms that own and manage more than 125,000 telecommunications facilities throughout the world.

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<sup>1</sup> *Second Report and Order and Second Further Notice of Proposed Rulemaking*, WP Docket No. 07-100, 25 FCC Rcd 2479 (2010) ("Further Notice" or "FNPR").

As a constituent member of the Land Mobile Communications Council since its inception, PCIA actively participated in the drafting of the most recent LMCC Comments submitted in this proceeding. Generally, PCIA is supportive of the views expressed in the LMCC Comments. However, as indicated in the LMCC Comments, PCIA has reservations with regard to the proposed protection criteria for radio systems eligible for protection in the bands below 470 MHz. Based upon PCIA's review of this issue, and in consultation with several land mobile consulting engineers, PCIA offers the following recommendations as to how to protect such systems going forward.

## **II. COMMENTS**

### **A. General Principles**

PCIA recognizes that these rules are being adopted at a time of significant changes in heavily utilized radio bands. Specifically, the industry is in the process of a multi-year, phased transition into more efficient transmission technologies, with a January 1, 2013 deadline. This transition is more than just a reduction in bandwidth. Rather, it coincides with the introduction of a variety of new technologies into the same spectrum. Thus, where the land mobile industry in these bands were traditionally occupied by wideband analog systems, going forward there will be a mix of analog and digital systems, narrowband and very narrowband systems, sharing the same channels, or on channels very closely adjacent to one another.

This transition happens while radio systems - public safety, critical infrastructure and business, are in operation. This transition in some cases will be more complicated than the rebanding initiative at 800 MHz. Therefore, great care must be taken in crafting rules which will serve the industry during the transition, as well as many years thereafter.

This transition is happening at the same time that new narrowband (and very narrowband) systems are being implemented. This creates more opportunities for interference for wideband systems the longer such system users wait to narrowband. The Commission is therefore presented with the conflicting goals of encouraging immediate narrowbanding action and maximizing spectrum opportunities, while at the same time trying to minimize interference to vital communications.

PCIA believes that the LMCC proposal represents an overly conservative approach. While a conservative approach was warranted when LMCC initially addressed this issue several years ago, it was always agreed that the issue should be revisited as experience was gained. Given the success of the implementation of narrowband (and very narrowband) systems thus far, PCIA believes that it is now appropriate to take a more aggressive approach in implementing additional narrowband systems and achieve the Commission's original goal of providing for greater spectral density in these bands.

PCIA's consultation with several consulting engineers has yielded the following recommendations:

**B. Use Of More Accurate Coverage Prediction Methodologies**

As the Commission is aware, there has been a significant amount of discussion within LMCC as to the best and most efficient methodology for predicting interference and coverage. While R-6602 curves and related methodologies have served the industry well over the past decades, it is recognized that advances in computer technology make it possible to utilize newer techniques without sacrificing coordination speed of service and without causing a significant amount of engineering litigation. Thus, at 470-512 MHz, frequency advisory committees have

begun the use of TIA/EIA/TSB-88.<sup>2</sup> Further, it has been recently acknowledged that the use of F(50,10)<sup>3</sup> interference criteria can lead to coverage prediction inaccuracies at certain distances. Therefore, LMCC has reviewed the feasibility of utilizing adjusted F(50,50) criteria for interference parameters for the potential new interstitial channels at 800 MHz.

As it is acknowledged that these tools and criteria yield more accurate results, PCIA proposes to utilize similar criteria for systems below 470 MHz. Because this proceeding involves adopting protection criteria which will continue after narrowbanding has been completed, it makes sense to take the opportunity now to maximize spectrum availability while increasing prediction accuracy. The more accurate coverage and interference can be predicted, the need for conservatism in protection parameters is reduced.

At the same time, it must be recognized that there are generally different system requirements for public safety radio systems, as compared to business/industrial radio systems. Public safety radio systems are typically constructed based upon an expected Delivered Audio Quality (DAQ) of 3.4,<sup>4</sup> while non-public safety systems are typically based upon a DAQ of 3.0.<sup>5</sup> As the industry migrates to a system of a variety of bandwidth and transmission technique systems on the same frequencies (or immediately adjacent), PCIA believes that these values should be recognized and, where appropriate, protected.

Finally, as narrowbanding continues, encouraging the rapid implementation of narrowband systems must be balanced against the need to ensure that public safety radio systems

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<sup>2</sup> See Telecommunications Industry Association/Electronics Industry Association Telecommunications Systems Bulletin 88 (TIA/EIA/TSB-88), *Wireline Communications System – Performance in Noise and Interference-Limited Situations – Recommended Methods for Technology-Independent Modeling, Simulation, and Verification* (January 1998).

<sup>3</sup> F(50,10) represents a calculation based upon fifty percent of locations, ten percent of the time.

<sup>4</sup> DAQ 3.4 is defined as 20 dB SINAD equivalent.

<sup>5</sup> DAQ 3.0 is defined as 17 dB SINAD equivalent.

are provided adequate protection during the transition. Therefore, it is PCIA's recommendation that eligible wideband public safety systems receive interference protection during the transition to narrowband, while non-public safety wideband systems should not be similarly protected.

PCIA's recommendations result in a series of interference charts, taking into account the variety of potential bandwidth, technology, protection criteria and channel center possibilities. The resulting charts from PCIA's recommended protection parameters can be seen in Appendix 1 attached hereto. The background for the calculations presented in Appendix 1 can be seen in the presentation in Exhibit 2. PCIA has reviewed the recommendations with several land mobile engineers, and PCIA feels comfortable that the recommendations are valid and feasible.<sup>6</sup>

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<sup>6</sup> See also, the article by Jay Jacobsmeyer of Pericle Communications in Urgent Magazine. [http://urgentcomm.com/networks\\_and\\_systems/mag/narrowbanding-system-coverage-effect-201004/](http://urgentcomm.com/networks_and_systems/mag/narrowbanding-system-coverage-effect-201004/).

### **III. CONCLUSION**

PCIA recognizes that these considerations and recommendations make frequency recommendations somewhat more complicated than in the past. However, PCIA believes that the criteria suggested herein can be implemented with tools already in use for 470-512 MHz with minor modifications. Further, the changes represent recognized parameters from other private land mobile radio bands. PCIA believes that its proposal represents a valid compromise between the needs of ensuring maximum opportunities for new narrowband systems, while adequately protecting existing and incumbent radio systems.

WHEREFORE, the premises considered, it is respectfully requested that the Commission act in accordance with the views expressed herein.

Respectfully submitted,

PCIA – The Wireless Infrastructure Association

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## **APPENDIX 1**

Black represents 4L-FSK FDMA  
 Red represents narrow band analog  
 Blue represents P25  
 Green represents 2-Slot DMR TDMA

70% Contour, DAQ=3.0, I/B victim							
UHF/VHF	Source	Channel Center Separation	Victim	C/I	ACPR	UHF(50,50)	VHF(50,50)
	ABW		ABW		TSB-88.1-C	Interfering	Interfering
1	4.00 kHz	6.25 kHz	4.00 kHz	21 dB	70 dB	88 dBµ	86 dBµ
2	4.00 kHz	6.25 kHz	11.25 kHz	28 dB	19 dB	30 dBµ	28 dBµ
3	4.00 kHz	6.25 kHz	11.25 kHz	21 dB	33 dB	51 dBµ	49 dBµ
4	4.00 kHz	6.25 kHz	11.25 kHz	19 dB	48 dB	68 dBµ	66 dBµ
5	4.00 kHz	12.50 kHz	4.00 kHz	21 dB	80 dB	98 dBµ	96 dBµ
6	4.00 kHz	12.50 kHz	11.25 kHz	28 dB	77 dB	88 dBµ	86 dBµ
7	4.00 kHz	12.50 kHz	11.25 kHz	21 dB	78 dB	96 dBµ	94 dBµ
8	4.00 kHz	12.50 kHz	11.25 kHz	19 dB	77 dB	97 dBµ	95 dBµ

70% Contour, DAQ=3.0, I/B victim							
UHF/VHF	Source	Channel Center Separation	Victim	C/I	ACPR	UHF(50,50)	VHF(50,50)
	ABW		ABW		TSB-88.1-C	Interfering	Interfering
1	4.00 kHz	7.25 kHz	4.00 kHz	21 dB	77 dB	93 dBµ	
2	4.00 kHz	7.25 kHz	11.25 kHz	28 dB	36 dB	45 dBµ	
3	4.00 kHz	7.25 kHz	11.25 kHz	21 dB	72 dB	88 dBµ	
4	4.00 kHz	7.25 kHz	11.25 kHz	19 dB	61 dB	79 dBµ	
5	4.00 kHz	15.00 kHz	4.00 kHz	21 dB	80 dB	96 dBµ	
6	4.00 kHz	15.00 kHz	11.25 kHz	28 dB	77 dB	86 dBµ	
7	4.00 kHz	15.00 kHz	11.25 kHz	21 dB	79 dB	95 dBµ	
8	4.00 kHz	15.00 kHz	11.25 kHz	19 dB	78 dB	96 dBµ	

70% Contour, DAQ=3.0, I/B victim							
UHF/VHF	Source	Channel Center Separation	Victim	C/I	ACPR	UHF(50,50)	VHF(50,50)
	ABW		ABW		TSB-88.1-C	Interfering	Interfering
1	11.25 kHz	6.25 kHz	4.00 kHz	21 dB	28 dB	46 dBµ	44 dBµ
2	11.25 kHz	6.25 kHz	11.25 kHz	28 dB	12 dB	23 dBµ	21 dBµ
3	11.25 kHz	6.25 kHz	11.25 kHz	21 dB	18 dB	36 dBµ	34 dBµ
4	11.25 kHz	6.25 kHz	11.25 kHz	19 dB	35 dB	33 dBµ	
5	11.25 kHz	12.50 kHz	4.00 kHz	21 dB	78 dB	96 dBµ	94 dBµ
6	11.25 kHz	12.50 kHz	11.25 kHz	28 dB	59 dB	70 dBµ	68 dBµ
7	11.25 kHz	12.50 kHz	11.25 kHz	21 dB	72 dB	90 dBµ	88 dBµ
8	11.25 kHz	12.50 kHz	11.25 kHz	19 dB	67 dB	87 dBµ	85 dBµ

70% Contour, DAQ=3.0, I/B victim							
UHF/VHF	Source	Channel Center Separation	Victim	C/I	ACPR	UHF(50,50)	VHF(50,50)
	ABW		ABW		TSB-88.1-C	Interfering	Interfering
1	11.25 kHz	7.25 kHz	4.00 kHz	21 dB	36 dB	52 dBµ	
2	11.25 kHz	7.25 kHz	11.25 kHz	28 dB	18 dB	27 dBµ	
3	11.25 kHz	7.25 kHz	11.25 kHz	21 dB	29 dB	45 dBµ	
4	11.25 kHz	7.25 kHz	11.25 kHz	19 dB	24 dB	42 dBµ	
5	11.25 kHz	15.00 kHz	4.00 kHz	21 dB	80 dB	96 dBµ	
6	11.25 kHz	15.00 kHz	11.25 kHz	28 dB	76 dB	85 dBµ	
7	11.25 kHz	15.00 kHz	11.25 kHz	21 dB	78 dB	94 dBµ	
8	11.25 kHz	15.00 kHz	11.25 kHz	19 dB	77 dB	95 dBµ	

70% Contour, DAQ=3.0, I/B victim							
UHF/VHF	Source	Channel Center Separation	Victim	C/I	ACPR	UHF(50,50)	VHF(50,50)
	ABW		ABW		TSB-88.1-C	Interfering	Interfering
1	11.25 kHz	6.25 kHz	4.00 kHz	21 dB	25 dB	43 dBµ	41 dBµ
2	11.25 kHz	6.25 kHz	11.25 kHz	28 dB	10 dB	21 dBµ	19 dBµ
3	11.25 kHz	6.25 kHz	11.25 kHz	21 dB	18 dB	36 dBµ	34 dBµ
4	11.25 kHz	6.25 kHz	11.25 kHz	19 dB	34 dB	32 dBµ	
5	11.25 kHz	12.50 kHz	4.00 kHz	21 dB	76 dB	94 dBµ	92 dBµ
6	11.25 kHz	12.50 kHz	11.25 kHz	28 dB	56 dB	67 dBµ	65 dBµ
7	11.25 kHz	12.50 kHz	11.25 kHz	21 dB	69 dB	87 dBµ	85 dBµ
8	11.25 kHz	12.50 kHz	11.25 kHz	19 dB	63 dB	83 dBµ	81 dBµ

70% Contour, DAQ=3.0, I/B victim							
UHF/VHF	Source	Channel Center Separation	Victim	C/I	ACPR	UHF(50,50)	VHF(50,50)
	ABW		ABW		TSB-88.1-C	Interfering	Interfering
1	11.25 kHz	7.25 kHz	4.00 kHz	21 dB	35 dB	51 dBµ	
2	11.25 kHz	7.25 kHz	11.25 kHz	28 dB	18 dB	27 dBµ	
3	11.25 kHz	7.25 kHz	11.25 kHz	21 dB	27 dB	42 dBµ	
4	11.25 kHz	7.25 kHz	11.25 kHz	19 dB	22 dB	40 dBµ	
5	11.25 kHz	15.00 kHz	4.00 kHz	21 dB	84 dB	100 dBµ	
6	11.25 kHz	15.00 kHz	11.25 kHz	28 dB	76 dB	85 dBµ	
7	11.25 kHz	15.00 kHz	11.25 kHz	21 dB	81 dB	97 dBµ	
8	11.25 kHz	15.00 kHz	11.25 kHz	19 dB	79 dB	97 dBµ	

70% Contour, DAQ=3.0, PS victim							
UHF/VHF	Source	Channel Center Separation	Victim	C/I	ACPR	UHF(50,50)	VHF(50,50)
	ABW		ABW		TSB-88.1-C	Interfering	Interfering
1	4.00 kHz	6.25 kHz	4.00 kHz	33 dB	70 dB	76 dBµ	74 dBµ
2	4.00 kHz	6.25 kHz	11.25 kHz	41 dB	20 dB	18 dBµ	16 dBµ
3	4.00 kHz	6.25 kHz	11.25 kHz	33 dB	48 dB	54 dBµ	52 dBµ
4	4.00 kHz	6.25 kHz	11.25 kHz	20 dB	36 dB	55 dBµ	53 dBµ
5	4.00 kHz	12.50 kHz	4.00 kHz	33 dB	80 dB	86 dBµ	84 dBµ
6	4.00 kHz	12.50 kHz	11.25 kHz	41 dB	77 dB	75 dBµ	73 dBµ
7	4.00 kHz	12.50 kHz	11.25 kHz	33 dB	78 dB	84 dBµ	82 dBµ
8	4.00 kHz	12.50 kHz	11.25 kHz	20 dB	77 dB	96 dBµ	94 dBµ

70% Contour, DAQ=3.4, PS victim							
UHF/VHF	Source	Channel Center Separation	Victim	C/I	ACPR	UHF(50,50)	VHF(50,50)
	ABW		ABW		TSB-88.1-C	Interfering	Interfering
1	4.00 kHz	7.25 kHz	4.00 kHz	33 dB	77 dB	81 dBµ	
2	4.00 kHz	7.25 kHz	11.25 kHz	41 dB	36 dB	32 dBµ	
3	4.00 kHz	7.25 kHz	11.25 kHz	33 dB	72 dB	76 dBµ	
4	4.00 kHz	7.25 kHz	11.25 kHz	20 dB	61 dB	78 dBµ	
5	4.00 kHz	15.00 kHz	4.00 kHz	33 dB	80 dB	84 dBµ	
6	4.00 kHz	15.00 kHz	11.25 kHz	41 dB	77 dB	73 dBµ	
7	4.00 kHz	15.00 kHz	11.25 kHz	33 dB	78 dB	82 dBµ	
8	4.00 kHz	15.00 kHz	11.25 kHz	20 dB	78 dB	95 dBµ	

95% Contour, DAQ=3.4, PS victim							
UHF/VHF	Source	Channel Center Separation	Victim	C/I	ACPR	UHF(50,50)	VHF(50,50)
	ABW		ABW		TSB-88.1-C	Interfering	Interfering
1	11.25 kHz	6.25 kHz	4.00 kHz	33 dB	31 dB	29 dBµ	
2	11.25 kHz	6.25 kHz	11.25 kHz	41 dB	9 dBµ	7 dBµ	
3	11.25 kHz	6.25 kHz	11.25 kHz	33 dB	25 dB	23 dBµ	
4	11.25 kHz	6.25 kHz	11.25 kHz	20 dB	14 dB	33 dBµ	
5	11.25 kHz	12.50 kHz	4.00 kHz	33 dB	76 dB	80 dBµ	
6	11.25 kHz	12.50 kHz	11.25 kHz	41 dB	56 dB	54 dBµ	
7	11.25 kHz	12.50 kHz	11.25 kHz	33 dB	69 dB	75 dBµ	
8	11.25 kHz	12.50 kHz	11.25 kHz	20 dB	64 dB	83 dBµ	

95% Contour, DAQ=3.4, PS victim							
UHF/VHF	Source	Channel Center Separation	Victim	C/I	ACPR	UHF(50,50)	VHF(50,50)
	ABW		ABW		TSB-88.1-C	Interfering	Interfering
1	11.25 kHz	7.25 kHz	4.00 kHz	33 dB	33 dB	39 dBµ	
2	11.25 kHz	7.25 kHz	11.25 kHz	41 dB	18 dB	14 dBµ	
3	11.25 kHz	7.25 kHz	11.25 kHz	33 dB	27 dB	31 dBµ	
4	11.25 kHz	7.25 kHz	11.25 kHz	20 dB	24 dB	41 dBµ	
5	11.25 kHz	15.00 kHz	4.00 kHz	33 dB	84 dB	88 dBµ	
6	11.25 kHz	15.00 kHz	11.25 kHz	41 dB	76 dB	72 dBµ	
7	11.25 kHz	15.00 kHz	11.25 kHz	33 dB	78 dB	82 dBµ	
8	11.25 kHz	15.00 kHz	11.25 kHz	20 dB	7		

## **APPENDIX 2**

# TSB-88.1-C CPC Requirements

- Assume the Log Normal standard deviation ( $\sigma$ ) is 6.5 dB
- Uses 3:1 rule for determining approximate Area Reliability based on Service Area Field Strength Contour
  - $70\% = 30\%$  below criterion at contour
  - $30\%/3 = 10\%$  below criteria over area
  - 10% produces 90% area
- Table D-7 used for criteria

# TSB-88.1-C Recommendations

**Table D - 6 Estimated Area Coverage Reliability**

Radio Service	Area Coverage Reliability
Public Safety	97%
LMR	90%

**Table D - 7 Assumed CPC**

Radio Service	CPC
Public Safety	DAQ -3.4 <sup>1</sup> Equivalent
LMR	DAQ -3.0 <sup>2</sup> Equivalent

<sup>1</sup>DAQ-3.4 is defined as 20 dB SINAD equivalent intelligibility (Table 2)

<sup>2</sup>DAQ-3 is defined as 17 dB SINAD equivalent intelligibility (Table 2)

Public Safety requires higher reliability and better DAQ due to the critical nature of their duties.

These recommendations were used for the details that follow

# Radios Models Selected

- For 6K00 Authorized Bandwidth
  - 4L-FSK using 4 kHz wide filter (RRC)
    - Labeled in black
- For 11K3 Authorized Bandwidth
  - FM Analog  $\pm 2.5$  kHz Deviation using 8K wide filter (Butterworth 4-3)
    - Labeled in red
  - Public Safety alternate, P25 using 6K wide filter (RRC)
    - Labeled in blue
  - Business alternate, DMR using 7.2K wide filter (RRC)
    - Labeled in green
- For 20K0 Authorized Bandwidth
  - Same as 11K3 FM as these will be converted to narrow band modulations by FCC rule before 1/1/2013

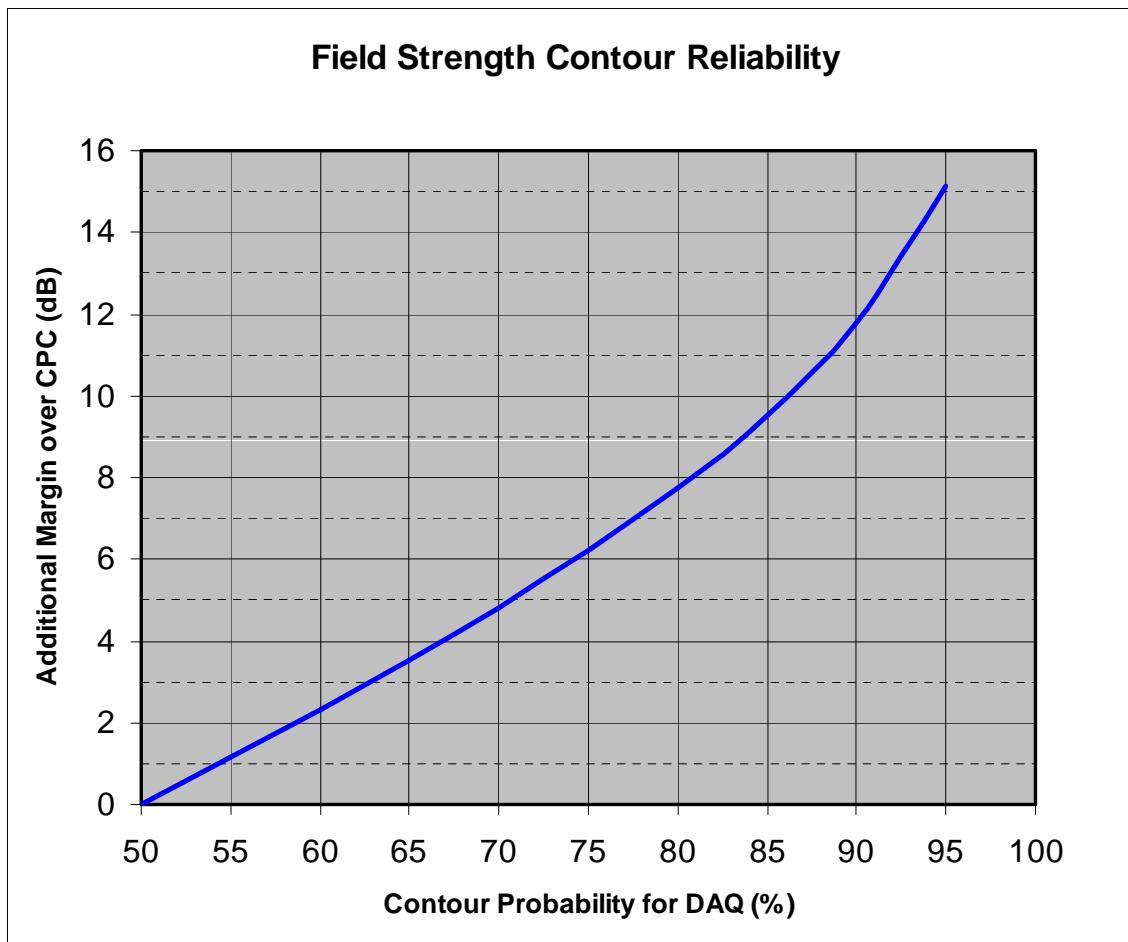
# Radio Performance Criteria

- 4L-FSK FDMA (NXDN)
  - 6K00 ABW
  - 4K00 emission designator
  - DAQ 3.0 = 16.3 dB
  - DAQ 3.4 = 17.5 dB
- Narrow Analog FM
  - 11K3 ABW
  - 11K0 emission designator
  - DAQ 3.0 = 23 dB
  - DAQ 3.4 = 26 dB
- P25 4L-FSK (C4FM)
  - 11K3 ABW
  - 8K10 emission designator
  - DAQ 3.0 = 16.5 dB
  - DAQ 3.4 = 17.7 dB
- ETSI DMR 2-slot TDMA
  - 11K3 ABW
  - 7K60 emission designator
  - DAQ 3.0 = 14.3 dB
  - DAQ 3.4 = 15.5 dB

Note the similarity to the 4L-FSK modulations for DAQ.

Analog FM is the worst case and is assumed to be the most likely conversion for radios that are not migrating to digital

# Margin to convert Contour to Area Reliability



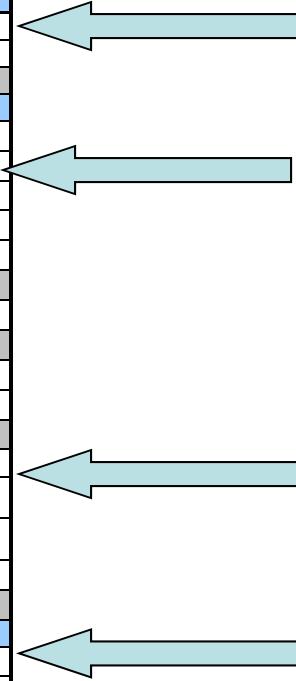
70% to 90% = 4.82 dB

95% to 97% = 15.1 dB

These margins are added to the DAQ to arrive at the C/I criteria at the edge of the service area (contour)

# TSB-88.1-C Data

<b>Modulation Type, (channel spacing)</b>	<b>Static<sup>1).</sup> <math>ref / \frac{C_s}{N}</math></b>	<b>DAQ-3.0<sup>2).</sup> <math>BER\% / \frac{C_f}{(I + N)}</math></b>	<b>DAQ-3.4<sup>3).</sup> <math>BER\% / \frac{C_f}{(I + N)}</math></b>	<b>DAQ-4.0<sup>4).</sup> <math>BER\% / \frac{C_f}{(I + N)}</math></b>
<b>Analog FM Radios</b>				
Analog FM $\pm$ 2.5kHz (12.5 kHz)	12 dB/7 dB	N/A/23 dB	N/A/26 dB	N/A/33 dB
Analog FM $\pm$ 4kHz (25 kHz) <sup>5)</sup>	12 dB/5 dB	N/A/19 dB	N/A/22 dB	N/A/29 dB
Analog FM $\pm$ 5kHz (25 kHz)	12 dB/4 dB	N/A/17 dB	N/A/20 dB	N/A/27 dB
<b>Digital FDMA Radios</b>				
C4FM (IMBE) (12.5 kHz) <sup>6)</sup>	5%/5.4 dB	2.6%/15.2 dB	2.0%/16.2 dB	1.0%/20.0 dB
C4FM (IMBE) (12.5 kHz) <sup>7)</sup>	5%/7.6 dB	2.6%/16.5 dB	2.0%/17.7 dB	1.0%/21.2 dB
C4FM (VSELP)* (12.5 kHz) <sup>7)</sup>	5%/7.6 dB	1.8%/17.4 dB	1.4%/19.0 dB	0.85%/21.6 dB
CQPSK (IMBE) LSM, 9.6 kb/s(12.5 kHz)	5%/6.5 dB	2.6%/15.7 dB	2.0%/17.0 dB	1.0%/20.5 dB
CQPSK (IMBE) WCQPSK, 9.6 kb/s (12.5 kHz)	5%/6.5 dB	2.6%/15.4 dB	2.0%/16.8 dB	1.0%/20.2 dB
CVSD "XL" CAE (25 kHz)	8.5%/4.0 dB	5.0%/12.0 dB	3.0%/16.5 dB	1.0%/20.5 dB
CVSD "XL" CAE (NPSPAC) <sup>8)</sup>	8.5%/4.0 dB	5.0%/14.0 dB	3.0%/18.5 dB	1.0%/22.5 dB
CVSD "XL" 4 Level (25 kHz)	8.5%/4.0 dB	5.0%/18.0 dB	3.0%/21.5 dB	1.0%/27.0 dB
EDACS® Narrowband Digital	5%/7.3 dB	2.6%/16.7 dB	2.0%/17.7 dB	1.0%/21.2 dB
EDACS® NPSPAC <sup>8</sup> Digital	5%/6.3 dB	2.6%/15.7 dB	2.0%/16.7 dB	1.0%/20.2 dB
EDACS® Wideband Digital (25 kHz)	5%/5.3 dB	2.6%/14.7 dB	2.0%/15.7 dB	1.0%/19.2 dB
dPMR 4.8 kb/s (AMBE+2) (6.25 kHz)	5%/7.8 dB	2.6%/16.3 dB	2.0%/17.5 dB	1.0%/20.8 dB
dPMR 4.8 kb/s (AMBE+2) (6.25 kHz)	5%/7.3 dB	2.6%/15.7 dB	2.0%/17.0 dB	1.0%/20.2 dB
dPMR 9.6 kb/s (AMBE+2) (12.5 kHz)	5%/7.0 dB	2.6%/15.5 dB	2.0%/16.7 dB	1.0%/19.9 dB
Tetrapol	5%/4.0 dB	1.8%/14.0 dB	1.4%/15.0 dB	0.85%/19.0 dB
WidePulse C4FM (25 kHz)	5%/9.8 dB	2.6%/17.2 dB	2.0%/18.5 dB	1.0%/21.8 dB
<b>Digital TDMA Radios</b>				
ETSI DMR 2 slot TDMA (AMBE +2) (12.5 kHz)	5%/5.3 dB	2.6%/14.3 dB	2.0%/15.6 dB	1%/19.4 dB
F4GFSK (AMBE) OpenSky®2-slot	5%/11.0 dB	3.5%/17.0 dB	2.5%/19.0 dB	1.3%/22.0 dB
F4GFSK (AMBE) OpenSky®4-slot	5%/11.0 dB	1.3%/22.0 dB	0.9%/24.0 dB	0.5%/27.0 dB
HDPQSK 12 kb/s (AMBE+2)	TBD	TBD	TBD	TBD
HCPM 12 kb/s (AMBE+2)	TBD	TBD	TBD	TBD



# TSB-88.1-C Receiver data

Modulation Type <sup>1)</sup>	ENBW (kHz)	IF Filter Simulation <sup>2),3)</sup>
<b>Analog FM Radios</b>		
Analog FM (25 kHz) ±5 kHz	16.0/12.6 <sup>4)</sup>	Butterworth 4 - 3
Analog FM (25 kHz) ±4 kHz (NPSPAC)	12.6/11.1 <sup>4)</sup>	Butterworth 4 - 3
Analog FM (12.5 kHz) ±2.5 kHz	7.8 <sup>5</sup>	Butterworth 4 - 3
C4FM / and analog FM (12.5 kHz) ±2.5 kHz	5.5 <sup>5</sup>	RRC, $\alpha=0.2$
<b>Digital FDMA Radios</b>		
C4FM (IMBE) (12.5 kHz)	5.5 <sup>5)</sup>	RRC, $\alpha=0.2$
CQPSK (6.25 kHz) None deployed	5.5	RRC, $\alpha=0.2$
CQPSK LSM (IMBE) (12.5 kHz)	5.5	RRC, $\alpha=0.2$
CQPSK WCQPSK (IMBE) (12.5 kHz)	6.3	RRC, $\alpha=0.2$
CVSD (25 kHz) ±4 kHz	12.6	Butterworth 4 - 3
CVSD (25 kHz) ±3 kHz NPSPAC	10.1	Butterworth 4 - 3
EDACS® (IMBE) (25 kHz)	8.0 / 6.9 <sup>6)</sup>	Butterworth 5 - 4/ 4 - 3
EDACS® (IMBE) (25 kHz NPSPAC)	7.5 / 6.2 <sup>6)</sup>	Butterworth 5 - 4/ 4 - 3
EDACS® (IMBE) (12.5 kHz)	6.7 / 5.4 <sup>6)</sup>	Butterworth 5 - 4/ 4 - 3
dPMR 4.8 kb/s (AMBE+2) (6.25kHz)	3.5	RRC, $\alpha=0.2$
NXDN™ 4.8 kb/s (AMBE+2) (6.25 kHz)	3.8	RRC, $\alpha=0.2$
NXDN™ 9.6 kb/s (AMBE+2) (12.5 kHz)	6.8	RRC, $\alpha=0.2$
Secure DVP (25 kHz)	12.6	Butterworth 4 - 3
Tetrapol (12.5 kHz)	7.2	Butterworth, 10 - 4
Wide Pulse (25 kHz)	12.6/11.1 <sup>4)</sup>	Butterworth 4 - 3
<b>Digital TDMA Radios</b>		
DMR 2 slot TDMA (AMBE +2) (12.5 kHz)	7.0	RRC, $\alpha=0.2$
F4GFSK (AMBE) OPENSKY® (25kHz)	12.4	Butterworth, 4 - 3
HDQPSK P25 Phase 2	TBD	TBD
HCPM P25 Phase 2	TBD	TBD

# Stability Correction

- Increase the ENBW over Receiver Data Table value to allow for frequency drift
- Correction =  $\sqrt{(\sigma_{base})^2 + (\sigma_{mobile})^2}$ 
  - VHF 6K00 = 134 Hz
  - UHF 6K00 = 201Hz (use 200 Hz)
  - VHF 11K3 = 335 Hz
  - UHF 11K3 = 527 Hz (use 500 Hz)

# Combinations

- 4 modulations
- 4 different filter bandwidths
- 4 center frequency offsets
- 2 different criteria
- This produces **64** different conditions
  - All are indicated but many have such large field strength margins that they should only be considered to prevent overlapping the adjacent channel site's allowed field strength contour

# VHF/UHF 25 kHz to I/B and PS

Black represents 4L-FSK FDMA  
 Red represents narrow band analog  
 Blue represents P25  
 Green represents 2-Slot DMR TDMA

70% Contour, DAQ=3.0, I/B victim							39 dB $\mu$	37 dB $\mu$
UHF/VHF	Souce	Channel Center Separation	Victim	C/I	ACPR	UHF(50,50) VHF(50,50)		
		ABW	ABW		TSB-88.1-C	Interfering	Interfering	
1	4.00 kHz	6.25 kHz	4.00 kHz	21 dB	70 dB	88 dB $\mu$	86 dB $\mu$	
2	4.00 kHz	6.25 kHz	11.25 kHz	28 dB	19 dB	30 dB $\mu$	28 dB $\mu$	
3	4.00 kHz	6.25 kHz	11.25 kHz	21 dB	33 dB	51 dB $\mu$	49 dB $\mu$	
4	4.00 kHz	6.25 kHz	11.25 kHz	19 dB	48 dB	68 dB $\mu$	66 dB $\mu$	
5	4.00 kHz	12.50 kHz	4.00 kHz	21 dB	80 dB	98 dB $\mu$	96 dB $\mu$	
6	4.00 kHz	12.50 kHz	11.25 kHz	28 dB	77 dB	88 dB $\mu$	86 dB $\mu$	
7	4.00 kHz	12.50 kHz	11.25 kHz	21 dB	78 dB	96 dB $\mu$	94 dB $\mu$	
8	4.00 kHz	12.50 kHz	11.25 kHz	19 dB	77 dB	97 dB $\mu$	95 dB $\mu$	

95% Contour, DAQ=3.4, PS victim							39 dB $\mu$	37 dB $\mu$
UHF/VHF	Souce	Channel Center Separation	Victim	C/I	ACPR	UHF(50,50) VHF(50,50)		
		ABW	ABW		TSB-88.1-C	Interfering	Interfering	
1	4.00 kHz	6.25 kHz	4.00 kHz	33 dB	70 dB	76 dB $\mu$	74 dB $\mu$	
2	4.00 kHz	6.25 kHz	11.25 kHz	41 dB	20 dB	18 dB $\mu$	16 dB $\mu$	
3	4.00 kHz	6.25 kHz	11.25 kHz	33 dB	48 dB	54 dB $\mu$	52 dB $\mu$	
4	4.00 kHz	6.25 kHz	11.25 kHz	20 dB	36 dB	55 dB $\mu$	53 dB $\mu$	
5	4.00 kHz	12.50 kHz	4.00 kHz	33 dB	80 dB	86 dB $\mu$	84 dB $\mu$	
6	4.00 kHz	12.50 kHz	11.25 kHz	41 dB	77 dB	75 dB $\mu$	73 dB $\mu$	
7	4.00 kHz	12.50 kHz	11.25 kHz	33 dB	78 dB	84 dB $\mu$	82 dB $\mu$	
8	4.00 kHz	12.50 kHz	11.25 kHz	20 dB	77 dB	96 dB $\mu$	94 dB $\mu$	

70% Contour, DAQ=3.0, I/B victim							39 dB $\mu$	37 dB $\mu$
UHF/VHF	Souce	Channel Center Separation	Victim	C/I	ACPR	UHF(50,50) VHF(50,50)		
		ABW	ABW		TSB-88.1-C	Interfering	Interfering	
1	11.25 kHz	6.25 kHz	4.00 kHz	21 dB	28 dB	46 dB $\mu$	44 dB $\mu$	
2	11.25 kHz	6.25 kHz	11.25 kHz	28 dB	12 dB	23 dB $\mu$	21 dB $\mu$	
3	11.25 kHz	6.25 kHz	11.25 kHz	21 dB	18 dB	36 dB $\mu$	34 dB $\mu$	
4	11.25 kHz	6.25 kHz	11.25 kHz	19 dB	15 dB	35 dB $\mu$	33 dB $\mu$	
5	11.25 kHz	12.50 kHz	4.00 kHz	21 dB	78 dB	96 dB $\mu$	94 dB $\mu$	
6	11.25 kHz	12.50 kHz	11.25 kHz	28 dB	59 dB	70 dB $\mu$	68 dB $\mu$	
7	11.25 kHz	12.50 kHz	11.25 kHz	21 dB	72 dB	90 dB $\mu$	88 dB $\mu$	
8	11.25 kHz	12.50 kHz	11.25 kHz	19 dB	67 dB	87 dB $\mu$	85 dB $\mu$	

95% Contour, DAQ=3.4, PS victim							39 dB $\mu$	37 dB $\mu$
UHF/VHF	Souce	Channel Center Separation	Victim	C/I	ACPR	UHF(50,50) VHF(50,50)		
		ABW	ABW		TSB-88.1-C	Interfering	Interfering	
1	11.25 kHz	6.25 kHz	4.00 kHz	33 dB	28 dB	34 dB $\mu$	32 dB $\mu$	
2	11.25 kHz	6.25 kHz	11.25 kHz	41 dB	12 dB	10 dB $\mu$	8 dB $\mu$	
3	11.25 kHz	6.25 kHz	11.25 kHz	33 dB	18 dB	24 dB $\mu$	22 dB $\mu$	
4	11.25 kHz	6.25 kHz	11.25 kHz	20 dB	15 dB	34 dB $\mu$	32 dB $\mu$	
5	11.25 kHz	12.50 kHz	4.00 kHz	33 dB	78 dB	84 dB $\mu$	82 dB $\mu$	
6	11.25 kHz	12.50 kHz	11.25 kHz	41 dB	59 dB	57 dB $\mu$	55 dB $\mu$	
7	11.25 kHz	12.50 kHz	11.25 kHz	33 dB	72 dB	78 dB $\mu$	76 dB $\mu$	
8	11.25 kHz	12.50 kHz	11.25 kHz	20 dB	68 dB	87 dB $\mu$	85 dB $\mu$	

70% Contour, DAQ=3.0, I/B victim							39 dB $\mu$	37 dB $\mu$
UHF/VHF	Souce	Channel Center Separation	Victim	C/I	ACPR	UHF(50,50) VHF(50,50)		
		ABW	ABW		TSB-88.1-C	Interfering	Interfering	
1	11.25 kHz	6.25 kHz	4.00 kHz	21 dB	25 dB	43 dB $\mu$	41 dB $\mu$	
2	11.25 kHz	6.25 kHz	11.25 kHz	28 dB	10 dB	21 dB $\mu$	19 dB $\mu$	
3	11.25 kHz	6.25 kHz	11.25 kHz	21 dB	18 dB	36 dB $\mu$	34 dB $\mu$	
4	11.25 kHz	6.25 kHz	11.25 kHz	19 dB	14 dB	34 dB $\mu$	32 dB $\mu$	
5	11.25 kHz	12.50 kHz	4.00 kHz	21 dB	76 dB	94 dB $\mu$	92 dB $\mu$	
6	11.25 kHz	12.50 kHz	11.25 kHz	28 dB	56 dB	67 dB $\mu$	65 dB $\mu$	
7	11.25 kHz	12.50 kHz	11.25 kHz	21 dB	69 dB	87 dB $\mu$	85 dB $\mu$	
8	11.25 kHz	12.50 kHz	11.25 kHz	19 dB	63 dB	83 dB $\mu$	81 dB $\mu$	

95% Contour, DAQ=3.4, PS victim							39 dB $\mu$	37 dB $\mu$
UHF/VHF	Souce	Channel Center Separation	Victim	C/I	ACPR	UHF(50,50) VHF(50,50)		
		ABW	ABW		TSB-88.1-C	Interfering	Interfering	
1	11.25 kHz	6.25 kHz	4.00 kHz	33 dB	25 dB	31 dB $\mu$	29 dB $\mu$	
2	11.25 kHz	6.25 kHz	11.25 kHz	41 dB	11 dB	9 dB $\mu$	7 dB $\mu$	
3	11.25 kHz	6.25 kHz	11.25 kHz	33 dB	18 dB	24 dB $\mu$	22 dB $\mu$	
4	11.25 kHz	6.25 kHz	11.25 kHz	20 dB	14 dB	33 dB $\mu$	31 dB $\mu$	
5	11.25 kHz	12.50 kHz	4.00 kHz	33 dB	76 dB	82 dB $\mu$	80 dB $\mu$	
6	11.25 kHz	12.50 kHz	11.25 kHz	41 dB	56 dB	54 dB $\mu$	52 dB $\mu$	
7	11.25 kHz	12.50 kHz	11.25 kHz	33 dB	69 dB	75 dB $\mu$	73 dB $\mu$	
8	11.25 kHz	12.50 kHz	11.25 kHz	20 dB	64 dB	83 dB $\mu$	81 dB $\mu$	

70% Contour, DAQ=3.0, I/B victim							39 dB $\mu$	37 dB $\mu$
UHF/VHF	Souce	Channel Center Separation	Victim	C/I	ACPR	UHF(50,50) VHF(50,50)		
		ABW	ABW		TSB-88.1-C	Interfering	Interfering	
1	11.25 kHz	6.25 kHz	4.00 kHz	21 dB	26 dB	44 dB $\mu$	42 dB $\mu$	
2	11.25 kHz	6.25 kHz	11.25 kHz	28 dB	11 dB	22 dB $\mu$	20 dB $\mu$	
3	11.25 kHz	6.25 kHz	11.25 kHz	21 dB	19 dB	37 dB $\mu$	35 dB $\mu$	
4	11.25 kHz	6.25 kHz	11.25 kHz	19 dB	15 dB	35 dB $\mu$	33 dB $\mu$	
5	11.25 kHz	12.50 kHz	4.00 kHz	21 dB	74 dB	92 dB $\mu$	90 dB $\mu$	
6	11.25 kHz	12.50 kHz	11.25 kHz	28 dB	59 dB	70 dB $\mu$	68 dB $\mu$	
7	11.25 kHz	12.50 kHz	11.25 kHz	21 dB	70 dB	88 dB $\mu$	86 dB $\mu$	
8	11.25 kHz	12.50 kHz	11.25 kHz	19 dB	65 dB	85 dB $\mu$	83 dB $\mu$	

95% Contour, DAQ=3.4, PS victim							39 dB $\mu$	37 dB $\mu$
UHF/VHF	Souce	Channel Center Separation	Victim	C/I	ACPR	UHF(50,50) VHF(50,50)		
		ABW	ABW		TSB-88.1-C	Interfering	Interfering	
1	11.25 kHz	6.25 kHz	4.00 kHz	33 dB	26 dB	32 dB $\mu$	30 dB $\mu$	
2	11.25 kHz	6.25 kHz	11.25 kHz	41 dB	11 dB	9 dB $\mu$	7 dB $\mu$	
3	11.25 kHz	6.25 kHz	11.25 kHz	33 dB	19 dB	25 dB $\mu$	23 dB $\mu$	
4	11.25 kHz	6.25 kHz	11.25 kHz	20 dB	15 dB	34 dB $\mu$	32 dB $\mu$	
5	11.25 kHz	12.50 kHz	4.00 kHz	33 dB	74 dB	80 dB $\mu$	78 dB $\mu$	
6	11.25 kHz	12.50 kHz	11.25 kHz	41 dB	59 dB	57 dB $\mu$	55 dB $\mu$	
7	11.25 kHz	12.50 kHz	11.25 kHz	33 dB	70 dB	76 dB $\mu$	74 dB $\mu$	
8	11.25 kHz	12.50 kHz	11.25 kHz	20 dB	66 dB	85 dB $\mu$	83 dB $\mu$	

# VHF 30 kHz to I/B and PS

Black represents 4L-FSK FDMA  
 Red represents narrow band analog  
 Blue represents P25  
 Green represents 2-Slot DMR TDMA

70% Contour, DAQ=3.0, I/B victim							37 dB $\mu$
UHF/VHF	Souce	Channel Center Separation	Victim	C/I	ACPR	VHF(50,50)	
	ABW	ABW	ABW	TSB-88.1-C	Interfering		
1	4.00 kHz	7.25 kHz	4.00 kHz	21 dB	77 dB	93 dB $\mu$	
2	4.00 kHz	7.25 kHz	11.25 kHz	28 dB	36 dB	45 dB $\mu$	
3	4.00 kHz	7.25 kHz	11.25 kHz	21 dB	72 dB	88 dB $\mu$	
4	4.00 kHz	7.25 kHz	11.25 kHz	19 dB	61 dB	79 dB $\mu$	
5	4.00 kHz	15.00 kHz	4.00 kHz	21 dB	80 dB	96 dB $\mu$	
6	4.00 kHz	15.00 kHz	11.25 kHz	28 dB	77 dB	86 dB $\mu$	
7	4.00 kHz	15.00 kHz	11.25 kHz	21 dB	79 dB	95 dB $\mu$	
8	4.00 kHz	15.00 kHz	11.25 kHz	19 dB	78 dB	96 dB $\mu$	

95% Contour, DAQ=3.4, PS victim							37 dB $\mu$
UHF/VHF	Souce	Channel Center Separation	Victim	C/I	ACPR	VHF(50,50)	
	ABW	ABW	ABW	TSB-88.1-C	Interfering		
1	4.00 kHz	7.25 kHz	4.00 kHz	33 dB	77 dB	81 dB $\mu$	
2	4.00 kHz	7.25 kHz	11.25 kHz	41 dB	36 dB	32 dB $\mu$	
3	4.00 kHz	7.25 kHz	11.25 kHz	33 dB	72 dB	76 dB $\mu$	
4	4.00 kHz	7.25 kHz	11.25 kHz	20 dB	61 dB	78 dB $\mu$	
5	4.00 kHz	15.00 kHz	4.00 kHz	33 dB	80 dB	84 dB $\mu$	
6	4.00 kHz	15.00 kHz	11.25 kHz	41 dB	77 dB	73 dB $\mu$	
7	4.00 kHz	15.00 kHz	11.25 kHz	33 dB	79 dB	83 dB $\mu$	
8	4.00 kHz	15.00 kHz	11.25 kHz	20 dB	78 dB	95 dB $\mu$	

70% Contour, DAQ=3.0, I/B victim							37 dB $\mu$
UHF/VHF	Souce	Channel Center Separation	Victim	C/I	ACPR	VHF(50,50)	
	ABW	ABW	ABW	TSB-88.1-C	Interfering		
1	11.25 kHz	7.25 kHz	4.00 kHz	21 dB	36 dB	52 dB $\mu$	
2	11.25 kHz	7.25 kHz	11.25 kHz	28 dB	18 dB	27 dB $\mu$	
3	11.25 kHz	7.25 kHz	11.25 kHz	21 dB	29 dB	45 dB $\mu$	
4	11.25 kHz	7.25 kHz	11.25 kHz	19 dB	24 dB	42 dB $\mu$	
5	11.25 kHz	15.00 kHz	4.00 kHz	21 dB	80 dB	96 dB $\mu$	
6	11.25 kHz	15.00 kHz	11.25 kHz	28 dB	76 dB	85 dB $\mu$	
7	11.25 kHz	15.00 kHz	11.25 kHz	21 dB	78 dB	94 dB $\mu$	
8	11.25 kHz	15.00 kHz	11.25 kHz	19 dB	77 dB	95 dB $\mu$	

95% Contour, DAQ=3.4, PS victim							37 dB $\mu$
UHF/VHF	Souce	Channel Center Separation	Victim	C/I	ACPR	VHF(50,50)	
	ABW	ABW	ABW	TSB-88.1-C	Interfering		
1	11.25 kHz	7.25 kHz	4.00 kHz	33 dB	36 dB	40 dB $\mu$	
2	11.25 kHz	7.25 kHz	11.25 kHz	41 dB	18 dB	14 dB $\mu$	
3	11.25 kHz	7.25 kHz	11.25 kHz	33 dB	29 dB	33 dB $\mu$	
4	11.25 kHz	7.25 kHz	11.25 kHz	20 dB	24 dB	41 dB $\mu$	
5	11.25 kHz	15.00 kHz	4.00 kHz	33 dB	80 dB	84 dB $\mu$	
6	11.25 kHz	15.00 kHz	11.25 kHz	41 dB	76 dB	72 dB $\mu$	
7	11.25 kHz	15.00 kHz	11.25 kHz	33 dB	78 dB	82 dB $\mu$	
8	11.25 kHz	15.00 kHz	11.25 kHz	20 dB	77 dB	94 dB $\mu$	

70% Contour, DAQ=3.0, I/B victim							37 dB $\mu$
UHF/VHF	Souce	Channel Center Separation	Victim	C/I	ACPR	VHF(50,50)	
	ABW	ABW	ABW	TSB-88.1-C	Interfering		
1	11.25 kHz	7.25 kHz	4.00 kHz	21 dB	35 dB	51 dB $\mu$	
2	11.25 kHz	7.25 kHz	11.25 kHz	28 dB	18 dB	27 dB $\mu$	
3	11.25 kHz	7.25 kHz	11.25 kHz	21 dB	27 dB	42 dB $\mu$	
4	11.25 kHz	7.25 kHz	11.25 kHz	19 dB	22 dB	40 dB $\mu$	
5	11.25 kHz	15.00 kHz	4.00 kHz	21 dB	84 dB	100 dB $\mu$	
6	11.25 kHz	15.00 kHz	11.25 kHz	28 dB	76 dB	85 dB $\mu$	
7	11.25 kHz	15.00 kHz	11.25 kHz	21 dB	81 dB	97 dB $\mu$	
8	11.25 kHz	12.50 kHz	11.25 kHz	19 dB	79 dB	97 dB $\mu$	

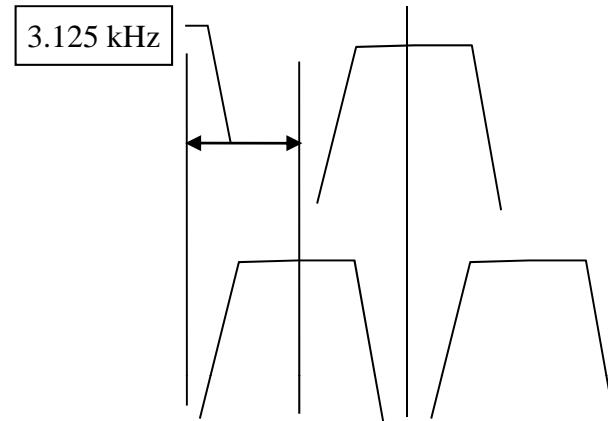
95% Contour, DAQ=3.4, PS victim							37 dB $\mu$
UHF/VHF	Souce	Channel Center Separation	Victim	C/I	ACPR	VHF(50,50)	
	ABW	ABW	ABW	TSB-88.1-C	Interfering		
1	11.25 kHz	7.25 kHz	4.00 kHz	33 dB	35 dB	39 dB $\mu$	
2	11.25 kHz	7.25 kHz	11.25 kHz	41 dB	18 dB	14 dB $\mu$	
3	11.25 kHz	7.25 kHz	11.25 kHz	33 dB	27 dB	31 dB $\mu$	
4	11.25 kHz	7.25 kHz	11.25 kHz	20 dB	22 dB	39 dB $\mu$	
5	11.25 kHz	15.00 kHz	4.00 kHz	33 dB	84 dB	88 dB $\mu$	
6	11.25 kHz	15.00 kHz	11.25 kHz	41 dB	76 dB	72 dB $\mu$	
7	11.25 kHz	15.00 kHz	11.25 kHz	33 dB	81 dB	85 dB $\mu$	
8	11.25 kHz	15.00 kHz	11.25 kHz	20 dB	79 dB	96 dB $\mu$	

70% Contour, DAQ=3.0, I/B victim							37 dB $\mu$
UHF/VHF	Souce	Channel Center Separation	Victim	C/I	ACPR	VHF(50,50)	
	ABW	ABW	ABW	TSB-88.1-C	Interfering		
1	11.25 kHz	7.25 kHz	4.00 kHz	21 dB	37 dB	53 dB $\mu$	
2	11.25 kHz	7.25 kHz	11.25 kHz	28 dB	19 dB	28 dB $\mu$	
3	11.25 kHz	7.25 kHz	11.25 kHz	21 dB	28 dB	44 dB $\mu$	
4	11.25 kHz	7.25 kHz	11.25 kHz	19 dB	24 dB	42 dB $\mu$	
5	11.25 kHz	15.00 kHz	4.00 kHz	21 dB	77 dB	93 dB $\mu$	
6	11.25 kHz	15.00 kHz	11.25 kHz	28 dB	73 dB	82 dB $\mu$	
7	11.25 kHz	15.00 kHz	11.25 kHz	21 dB	75 dB	91 dB $\mu$	
8	11.25 kHz	15.00 kHz	11.25 kHz	19 dB	74 dB	92 dB $\mu$	

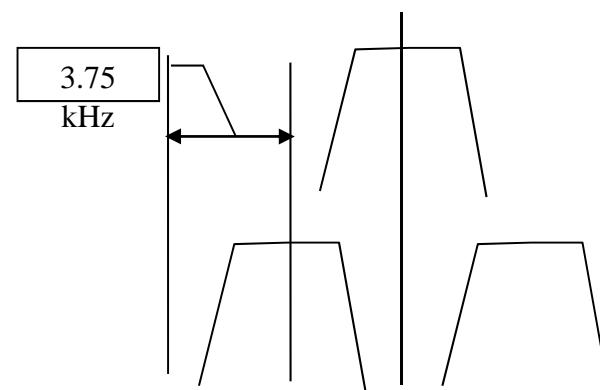
95% Contour, DAQ=3.4, PS victim							37 dB $\mu$
UHF/VHF	Souce	Channel Center Separation	Victim	C/I	ACPR	VHF(50,50)	
	ABW	ABW	ABW	TSB-88.1-C	Interfering		
1	11.25 kHz	7.25 kHz	4.00 kHz	33 dB	37 dB	41 dB $\mu$	
2	11.25 kHz	7.25 kHz	11.25 kHz	41 dB	19 dB	15 dB $\mu$	
3	11.25 kHz	7.25 kHz	11.25 kHz	33 dB	28 dB	32 dB $\mu$	
4	11.25 kHz	7.25 kHz	11.25 kHz	20 dB	24 dB	41 dB $\mu$	
5	11.25 kHz	15.00 kHz	4.00 kHz	33 dB	77 dB	81 dB $\mu$	
6	11.25 kHz	15.00 kHz	11.25 kHz	41 dB	73 dB	69 dB $\mu$	
7	11.25 kHz	15.00 kHz	11.25 kHz	33 dB	75 dB	79 dB $\mu$	
8	11.25 kHz	15.00 kHz	11.25 kHz	20 dB	74 dB	91 dB $\mu$	

# Special Cases

- UHF 12.5 kHz
  - 4K00 – 4K00
  - 3.125 kHz center separation
  - ACPR = 12.0 dB



- VHF 12.5 kHz
  - 4K00 – 4K00
  - 3.75 kHz center separation
  - ACPR = 22.1 dB



UHF/VHF	Source	70% Contour, DAQ=3.0, I/B victim			C/I	ACPR	39 dB $\mu$	37 dB $\mu$
		Channel Center Separation	Victim	ABW			UHF(50,50)	VHF(50,50)
1	4.00 kHz	3.125 kHz	4.00 kHz	ABW	21 dB	TSB-88.1-C	Interfering	Interfering
2	4.00 kHz	3.75 kHz	4.00 kHz	ABW	21 dB	22 dB	30 dB $\mu$	38 dB $\mu$

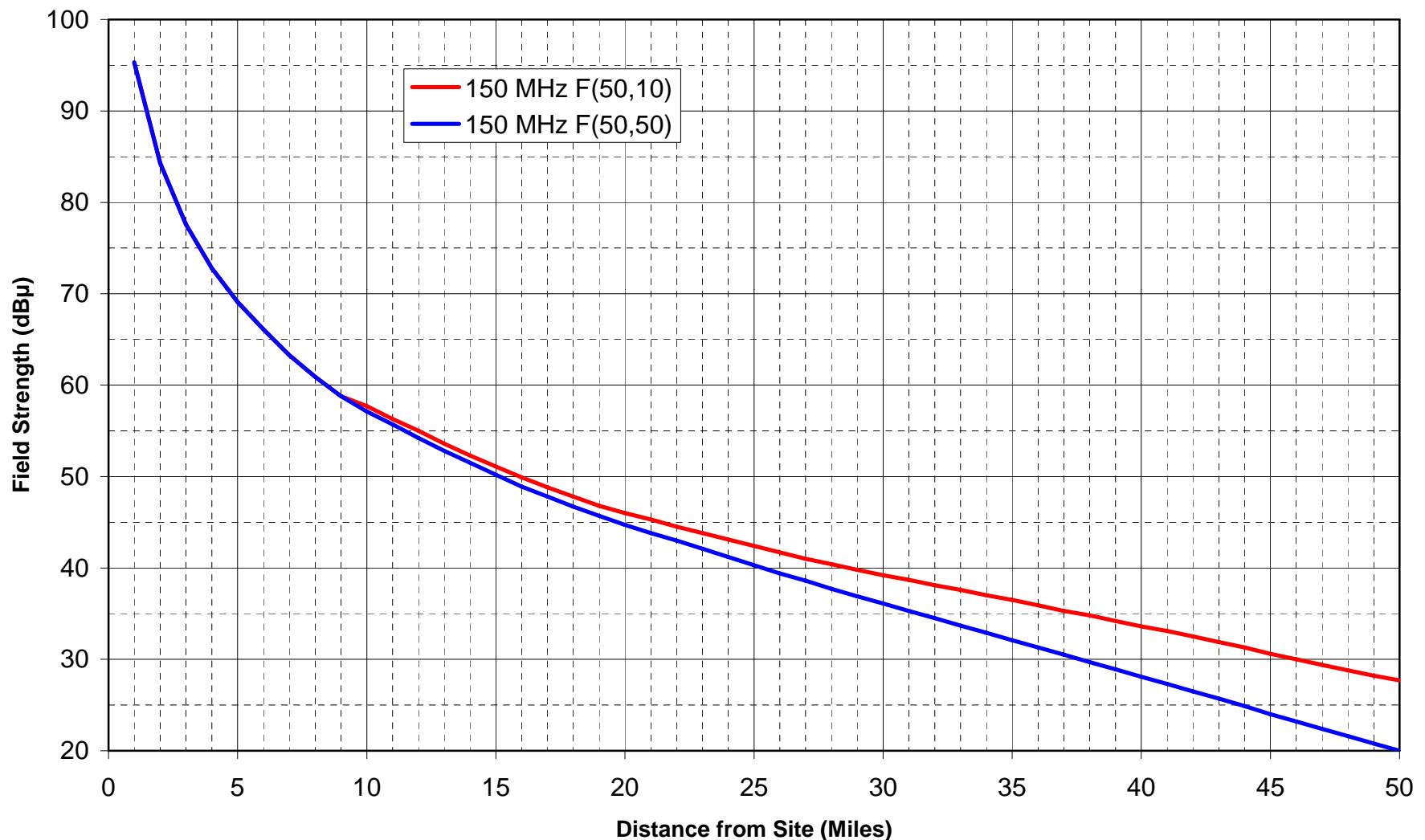
# Why F(50,50) rather than F(50,10)

- F(50,10) was developed for broadcasters and is inappropriate for land mobile systems
  - Time includes long term fading
    - Based on antennas 30 ft AGL
    - Rayleigh fading for medium length paths
    - Decreased Rayleigh fading for longer paths
      - This is why the curves dip at longer distances
    - Rician fading on short paths where the dominant signal is a short line of sight path
- F(50,50) is appropriate for land mobile systems
  - Time is included by using a faded sensitivity value
  - The Rayleigh fading is always present and the faded sensitivity provides the necessary performance margins
  - The F(50,10) curves do not provide the necessary statistical values when separation distances are reduced as is the case for adjacent channel coordination

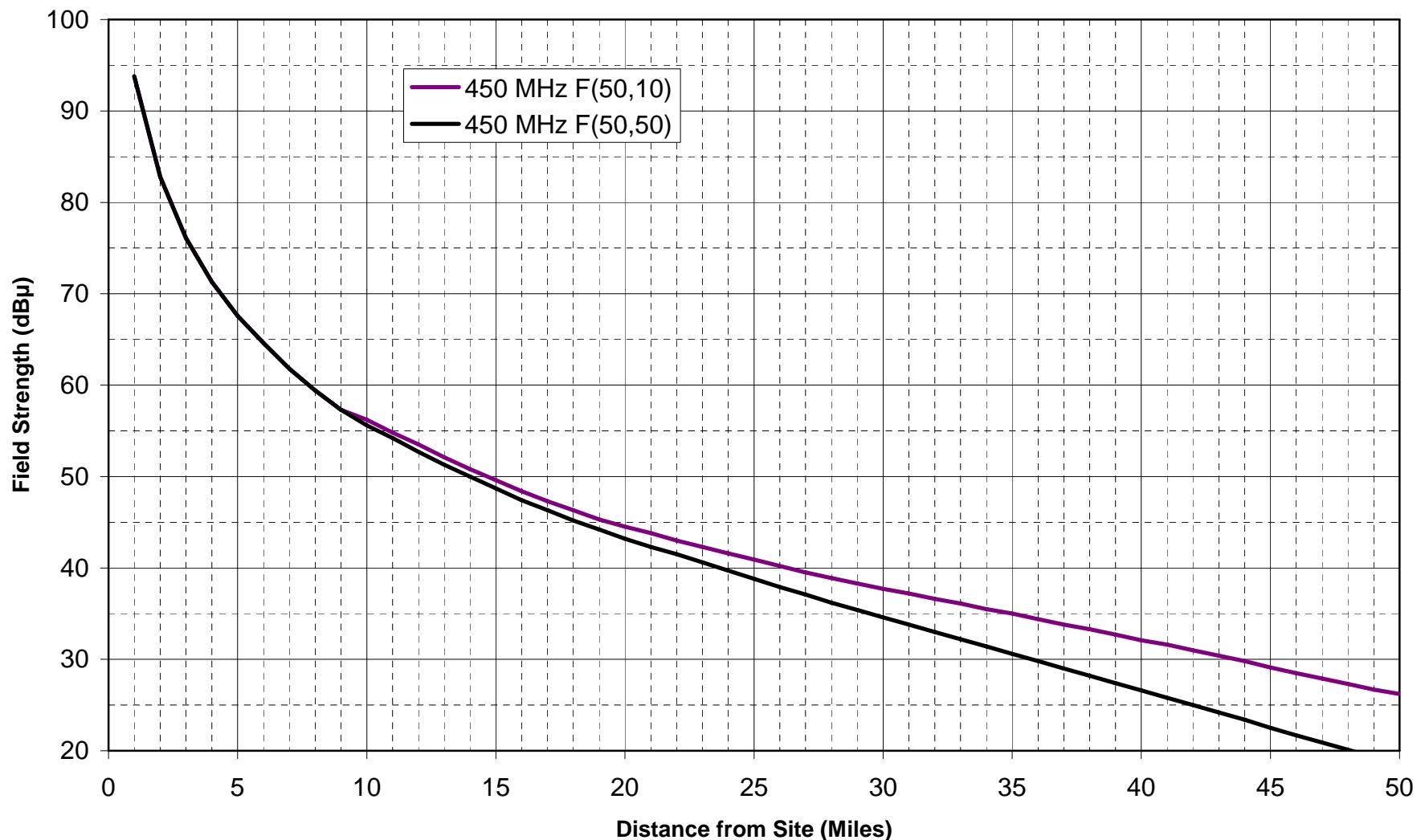
# R6602 Distance Example

- These examples use R6602 and calculates the field strength vs. distance from the site. The ERP is 250 Watts and the HAAT is 250 feet.

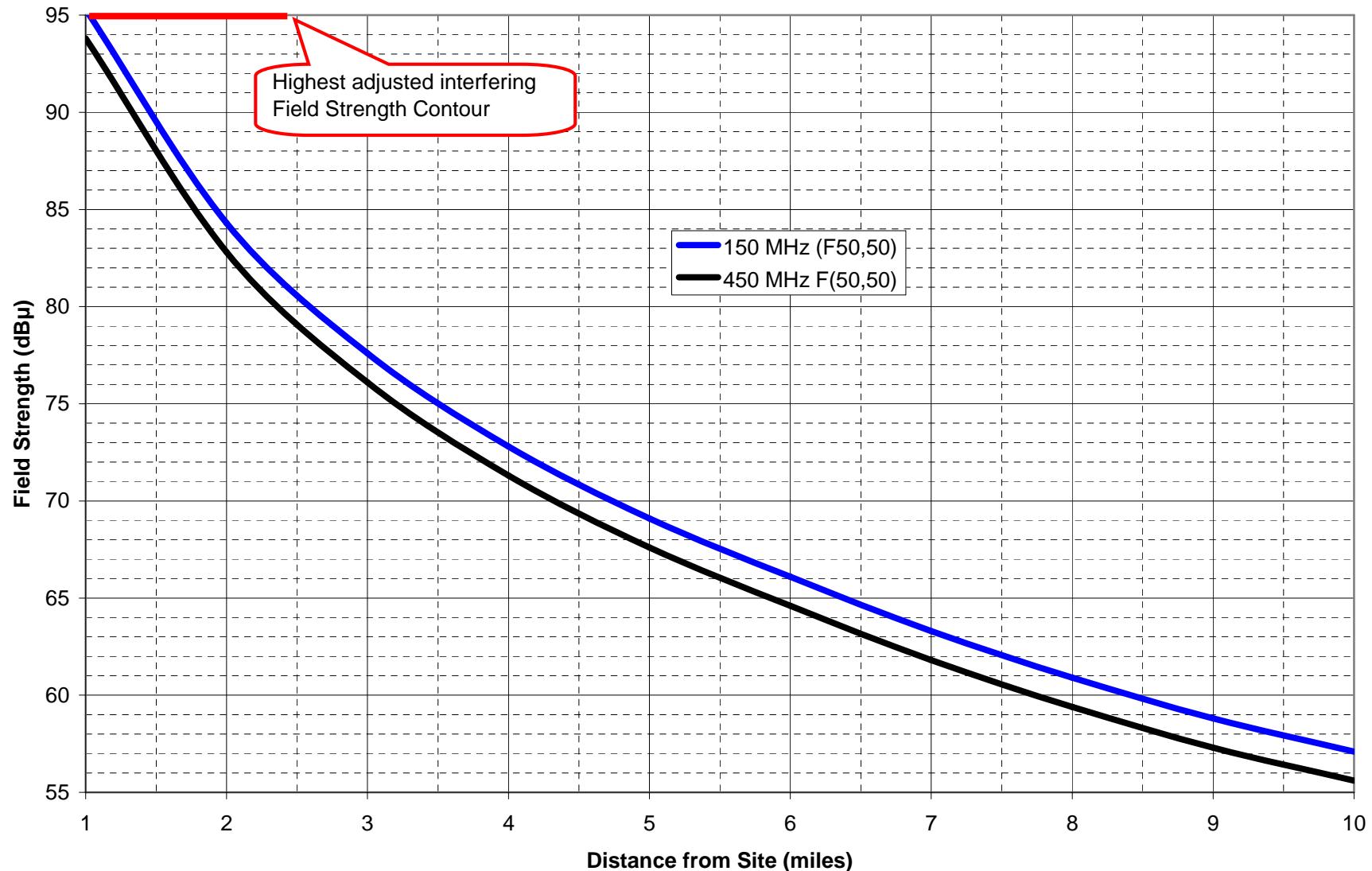
## Field Strength - 250 Watts ERP, 250 Ft HAAT



## Field Strength - 250 Watts ERP, 250 Ft HAAT



### R6602, Calculated Field Strength - 250 W ERP, 250 Ft. HAAT



# Recommendation

- Do not use the FCC proposed 90.189 table as it will result in near/far problems
- Use the methods outlined in these slides to determine the adjusted field strength using the criteria listed and from that the distance for the (50,50)interfering contour to the desired (50,50) contour. This prevents the interfering contour from overlapping the adjacent channel's site which can occur if a Not Affected status is utilized.

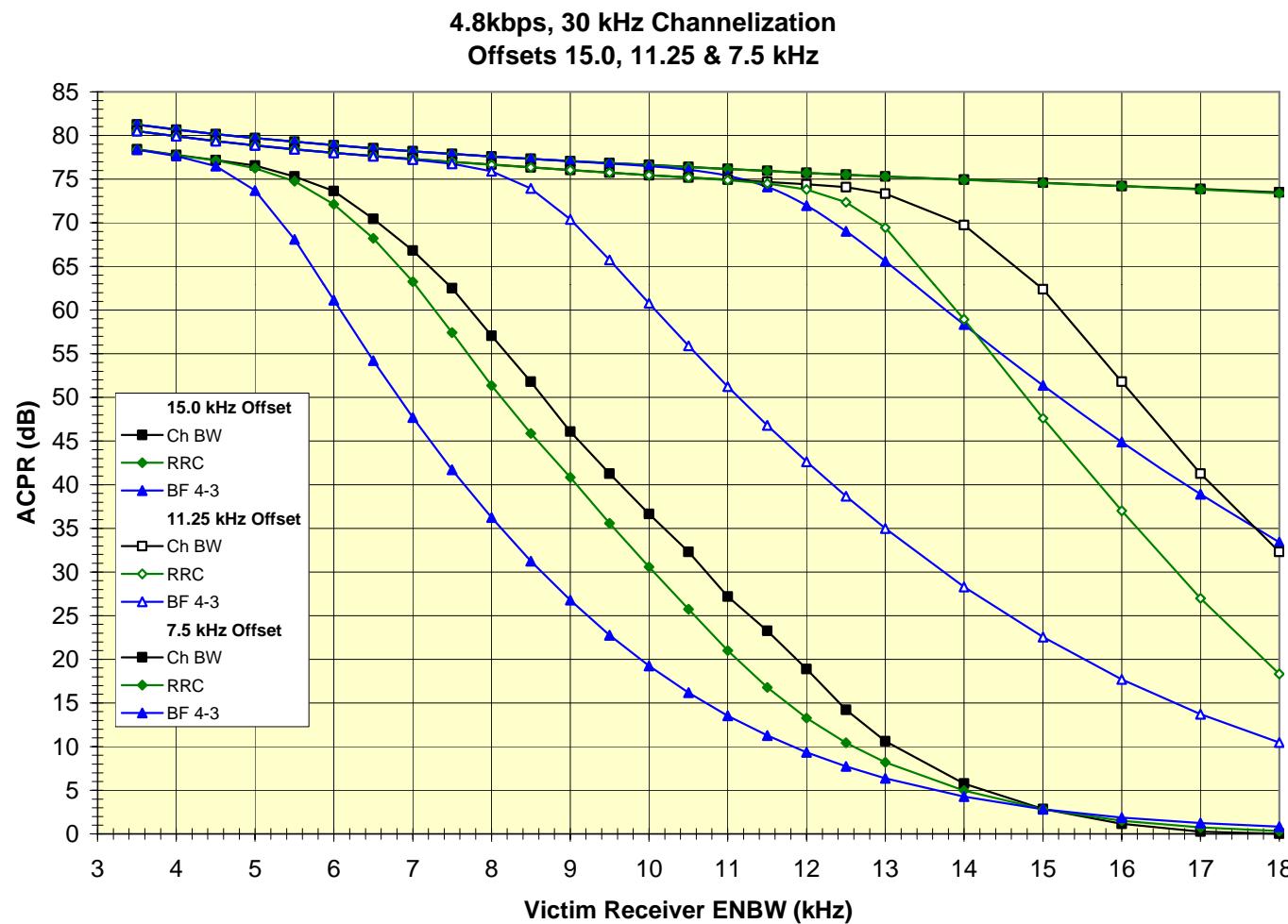
# Recommendation Continued

- For examples not shown use TSB-88.1-C for a more detailed engineering study
  - Based on their emission designators, the modulation and receiver characteristics of both the interferer source and victim are known
  - Determine the F(50,50) desired and adjusted F(50,50) interfering contour based on the contour reliability.
  - If they do not overlap in either case (evaluate both cases) then an assignment can be made.

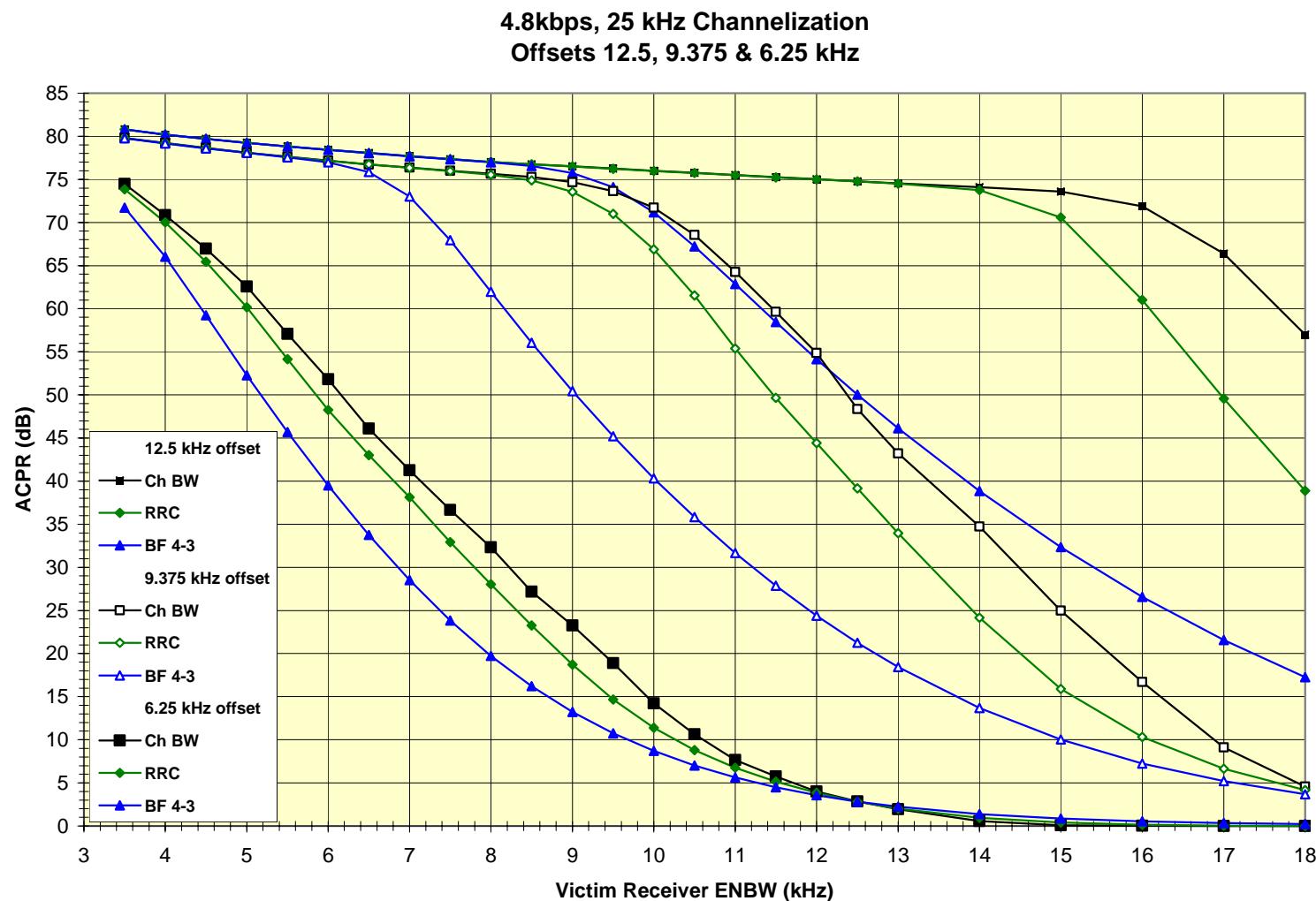
# Additional Slides

Used to determine the ACPR for  
tables

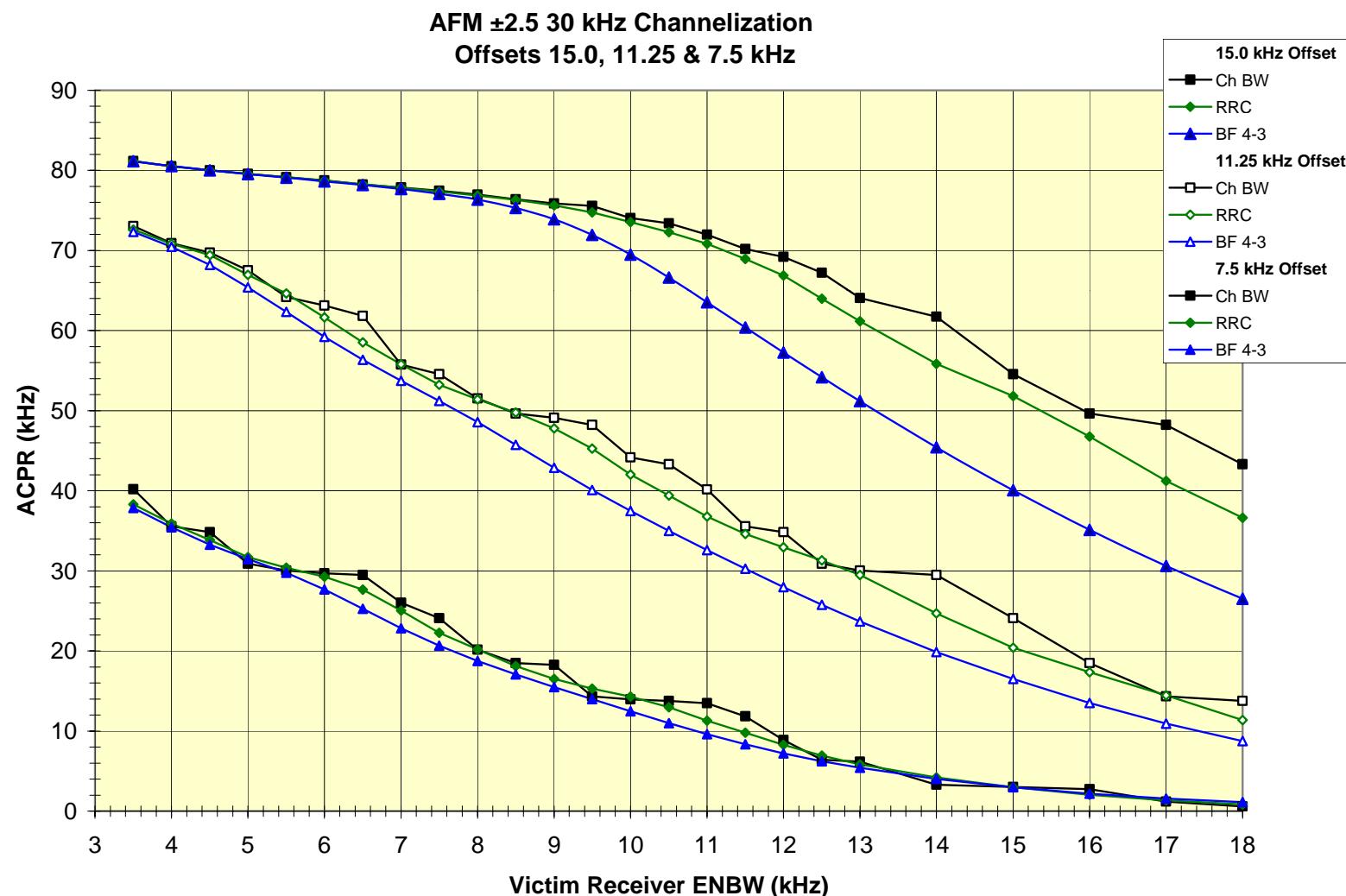
# VHF 4L-FSK ACPR



# UHF 4L FSK FDMA ACPR

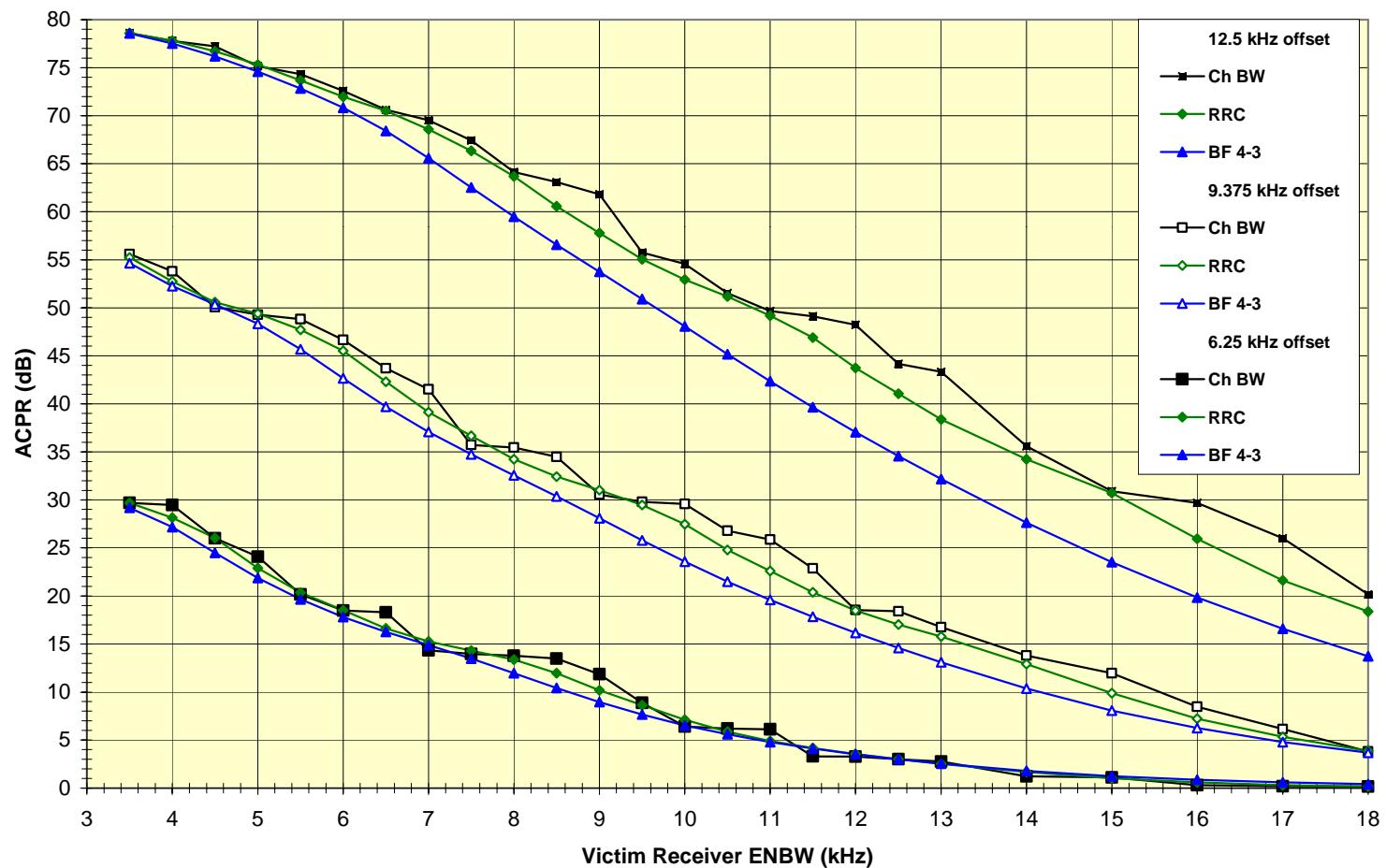


# VHF Analog FM ACPR

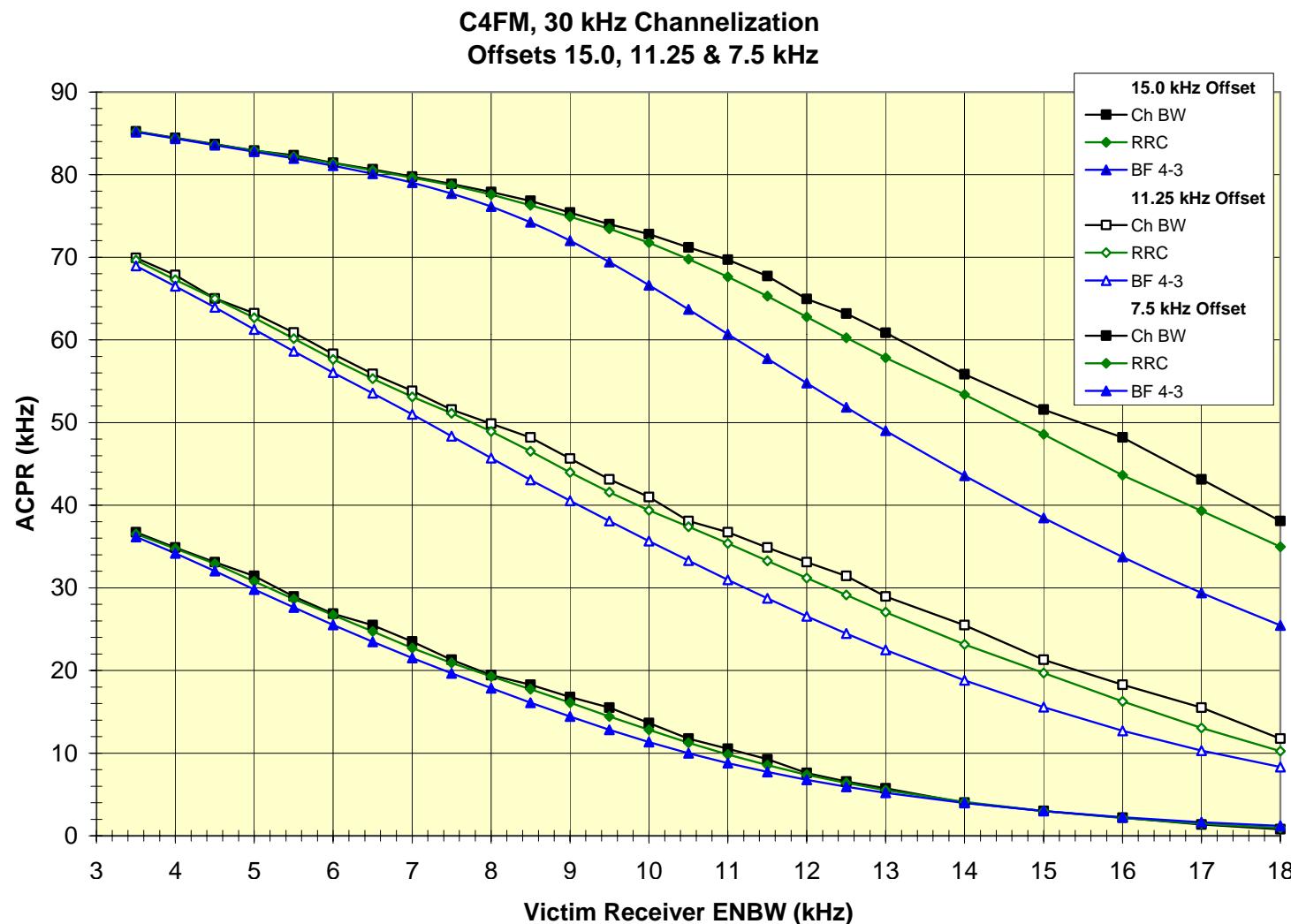


# UHF Analog FM ACPR

AFM  $\pm 2.5$ , 25 kHz Channelization  
Offsets 12.5, 9.375 & 6.25 kHz

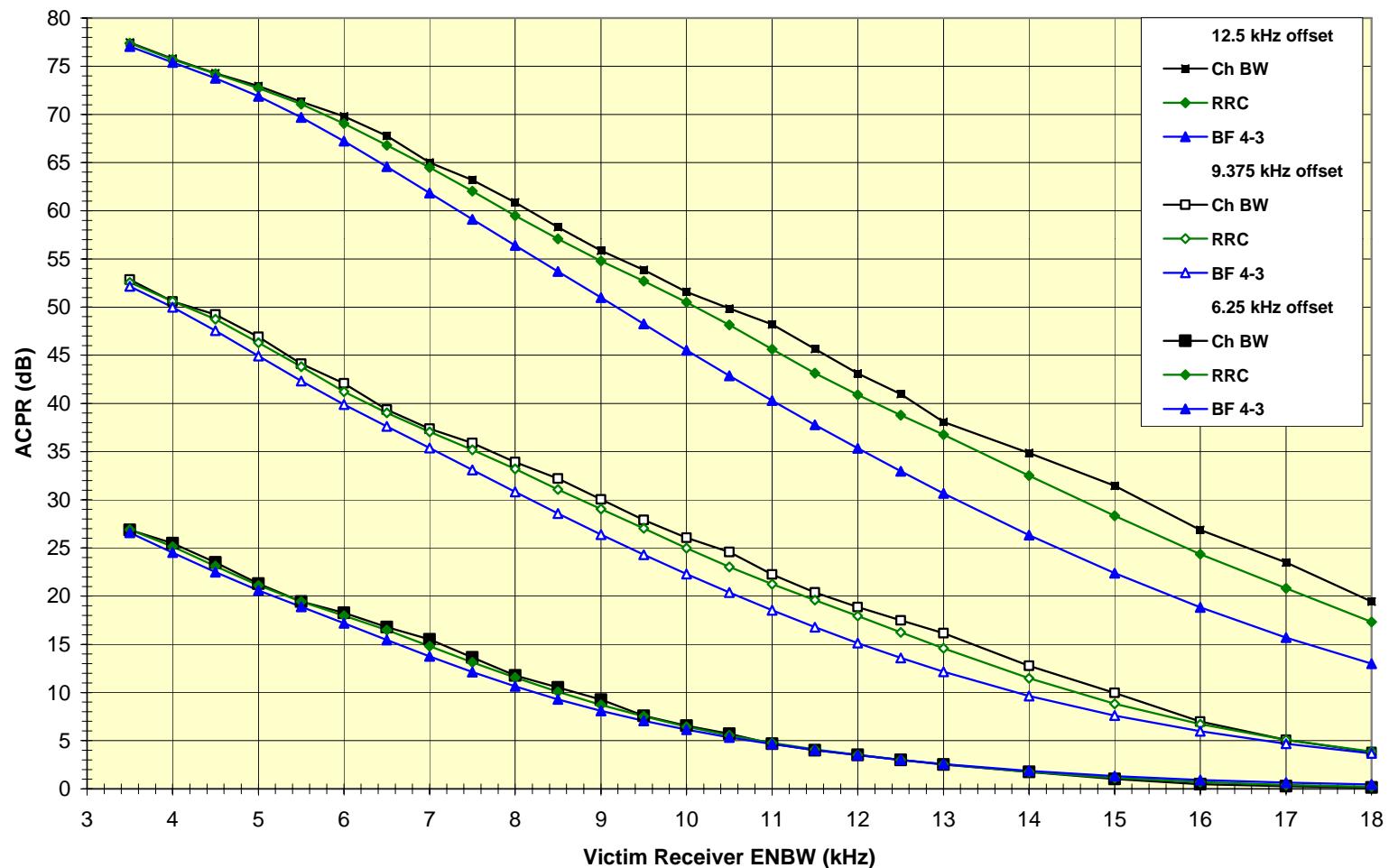


# VHF P25 ACPR

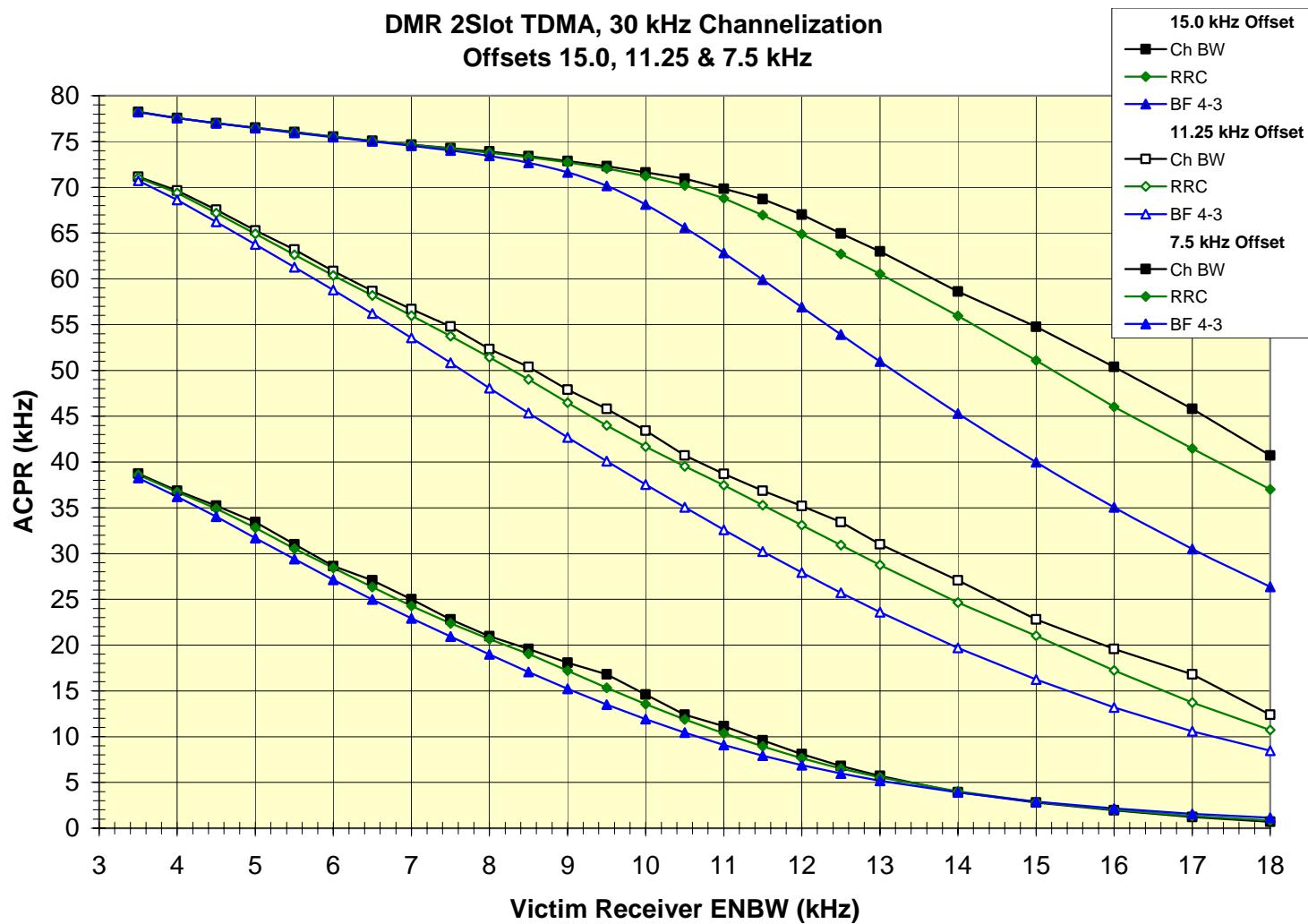


# UHF P25 C4FM ACPR

C4FM, 25 kHz Channelization  
Offsets 12.5, 9.375 & 6.25 kHz



# VHF DMR 2-Slot FDMA



# UHF DMR 2-Slot FDMA

